Name of Faculty	:	Faculty of Pharmacy
Name of Program	:	Master in Pharmacy
Course Code	:	1MPH02
Course Title	:	Drug Delivery Systems
Type of Course	:	Pharmaceutics
Year of Introduction	:	2023-24

Prerequisite	:	To have sufficient knowledge about basics of pharmaceutical dosage forms
Course Objective	:	This course is designed to impart knowledge on the area of advances in novel drug delivery systems.
Course Outcomes	:	At the end of this course, students will be able to understand.
	CO1	To understand the principles & fundamentals in development on novel drug delivery systems
	CO2	To learn various approaches for development of novel drug delivery systems
	CO3	To apply the basic knowledge to understand the criteria for selection of drugs and polymers for the development of delivering system
	CO4	To Evaluate drug delivery systems for physico-chemical characteristics, *in vitro* and *in vivo* drug release
	CO5	To analyze the parameters for personalized medicine and tele pharmacy in the optimization of therapy in patients
	CO6	To understand protein drugs and biological products such as vaccines in their development and evaluation

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	SEE	CIA	SEE	CIA	
4	0	0	4	75	25	00	00	100

*Legends: **L**-Lecture; **T**–Tutorial/Teacher Guided Theory Practice; **P** – Practical, **C** – Credit, **SEE** – Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with COs
1	Sustained Release(SR) and Controlled Release (CR) formulations: Introduction & basic concepts, advantages/ disadvantages, factors influencing, Physicochemical & biological approaches for SR/CR formulation, Mechanism of Drug Delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Tele pharmacy.	10	16.66%	CO1 CO2 CO3 CO4 CO5
2	Rate Controlled Drug Delivery Systems: Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems; Mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feedback regulated Drug Delivery Systems; Principles & Fundamentals.	10	16.66%	CO1 CO2 CO3
3	Gastro-Retentive Drug Delivery Systems: Principle, concepts advantages and disadvantages, Modulation of GI transit time approaches to extend GI transit. Buccal Drug Delivery Systems: Principle of muco adhesion, advantages and disadvantages, Mechanism of drug permeation, Methods of formulation and its evaluations.	10	16.66%	CO1 CO2 CO3
4	Occular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers.	06	10%	CO1 CO2 CO3
5	Transdermal Drug Delivery Systems: Structure of skin and barriers, Penetration enhancers, Transdermal Drug Delivery Systems, Formulation and evaluation.	10	16.66%	CO1 CO2 CO3
6	Protein and Peptide Delivery: Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules.	08	13.33%	CO1 CO2 CO3 CO6
7	Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines.	06	10%	CO1 CO2 CO3

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	**16.66**	**33.33**	**16.66**	**16.66**	**16.66**	**0**

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested Learning Websites

Sr. No.	Name of Website
1	https://www.ich.org
2	https://www.fda.gov/drugs
3	https://www.pharmaguideline.net
4	https://pci.nic.in/pdf/Syllabus_B_Pharm.pdf
5	https://www.aicte-india.org/downloads/bpharma.pdf.
6	https://www.ipc.gov.in/
7	https://www.ayush.gov.in/
8	https://ayudmla.gujarat.gov.in/home.php
9	https://www.fda.gov/
10	https://www.pharmacopoeia.com/
11	https://ipapharma.org/
12	https://gpat.nta.nic.in/
13	https://drnaitiktrivedi.com/
14	https://gdc4gpat.com/course/gpat/
15	https://niscpr.res.in/
16	https://delnet.in/
17	https://ihubgujarat.in/
18	https://www.ssipgujarat.in/

Recommended Books (Latest Editions)

Sr. No.	Name of Reference Books
1	Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2	Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker,Inc., New York, 1992.
3	Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York! Chichester/Weinheim
4	N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5	S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh

		Prakashan, New Delhi, First edition 2002
6		JOURNALS
7		Indian Journal of Pharmaceutical Sciences (IPA)
8		Indian drugs (IDMA)
9		Journal of controlled release (Elsevier Sciences) desirable
10		Drug Development and Industrial Pharmacy (Marcel & Decker) desirable